
*TOPEX/POSEIDON PROJECT SATELLITE/SENSORS
PERFORMANCE CHARACTERISTICS WORKSHOP #11*

OPERATIONAL TRAJECTORY PRODUCTS

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NAV/PVT

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Topex/Poseidon Satellite/Sensors Performance Workshop #11
Operational Trajectory Products



Contents



-
- **Operational Orbit Ephemeris (OOE) Performance**
 - **On-Board Computer (OBC) Ephemeris Performance**
 - **Other Orbit Products: OEF, ORF**



OOE Performance



REQUIREMENTS

- The accuracy requirements for the OOE are (all 3 σ):

Sequence Development (OEF)	± 20 km after 7 days
OBC Ephemeris	± 6 km after 7 days
Ground Track Repeatability	± 750 m at Ascending Node after 30 days
IGDR Data Location	± 1 km after 5 days
DORIS Initialization	± 3 km along-track after 5 days

- Driving requirement is for Ground Track Repeatability



OOE Performance



- The OOE accuracy can be achieved by direct comparison with the Precision Orbit Ephemeris (POE) and/or Medium Orbit Ephemeris, GPS and SLR data, (MOE)
- Comparison with MOE vectors is presented to show that using MOE results are acceptable for TOPEX orbit and ground track monitoring if FDF support is not available
- Extended Precision Vectors (EPVs) received from the GSFC/FDF are compared with the POE on 20 selected days between June 2001 and Sept 2001.
- Comparisons are performed in orbit plane coordinates.

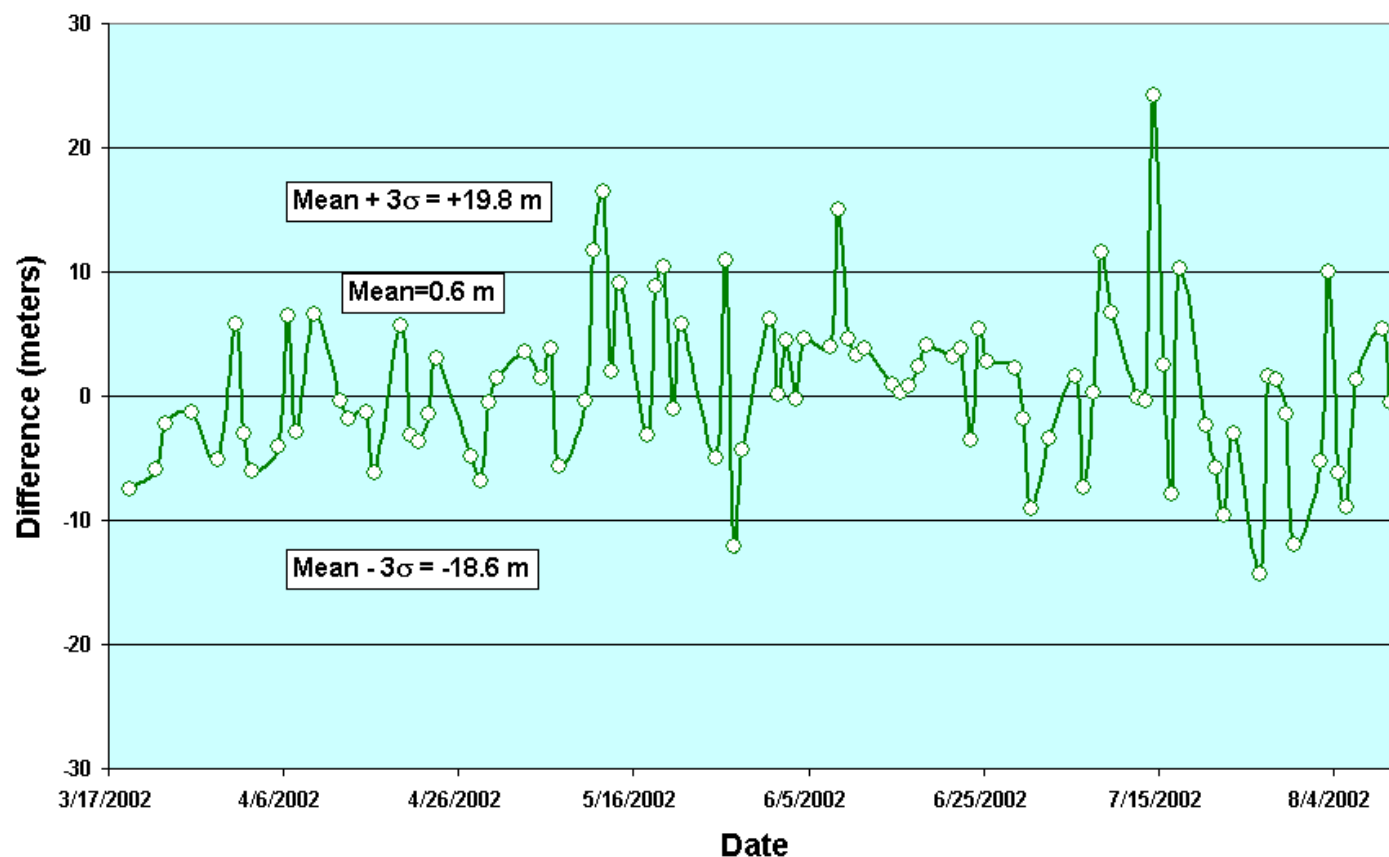
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OOE Performance



OOE-MOE EPV Orbital Parameters Along-track Difference



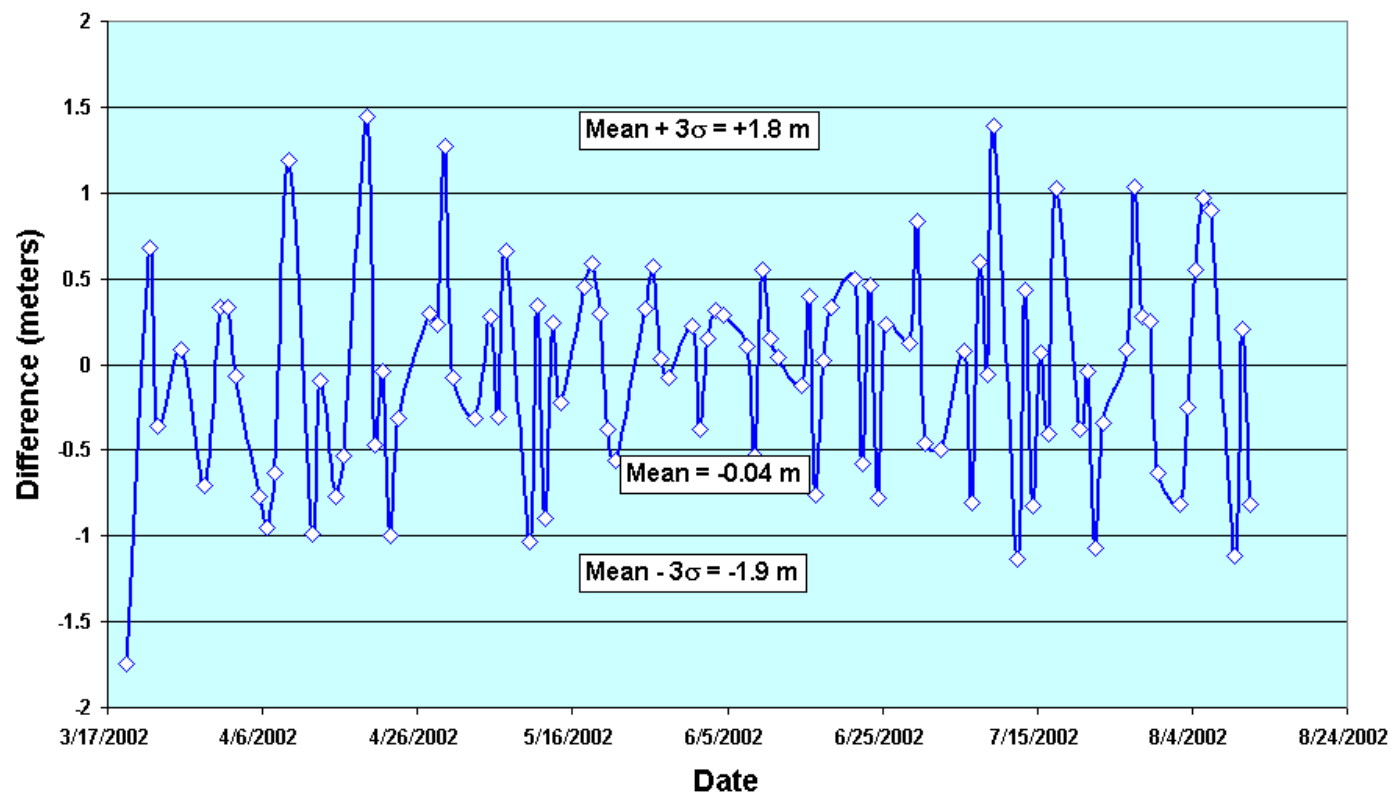
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OOE Performance



OOE-MOE EPV Orbital Parameters Cross-track Difference



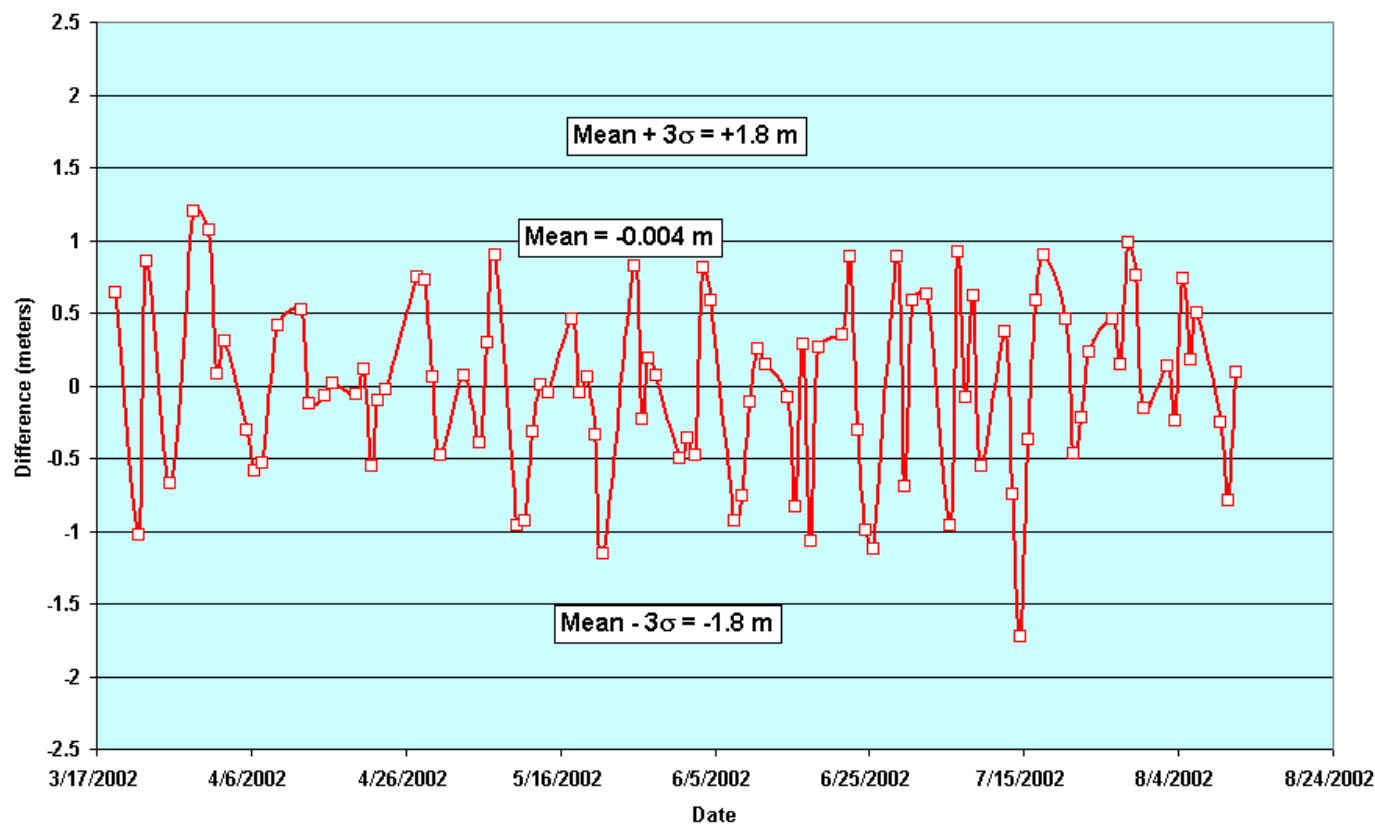
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OOE Performance



OOE-MOE EPV Orbital Parameters Radial Difference



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OOE Performance



- It agrees very well with the MOE:

Position differences (m)	Min.	Max.	Mean	Standard deviation
Radial	-1.7	1.2	-0.004	0.6
Along Track	-14.4	24.3	+0.6	6.4
Cross Track	-1.7	1.4	-0.041	0.6

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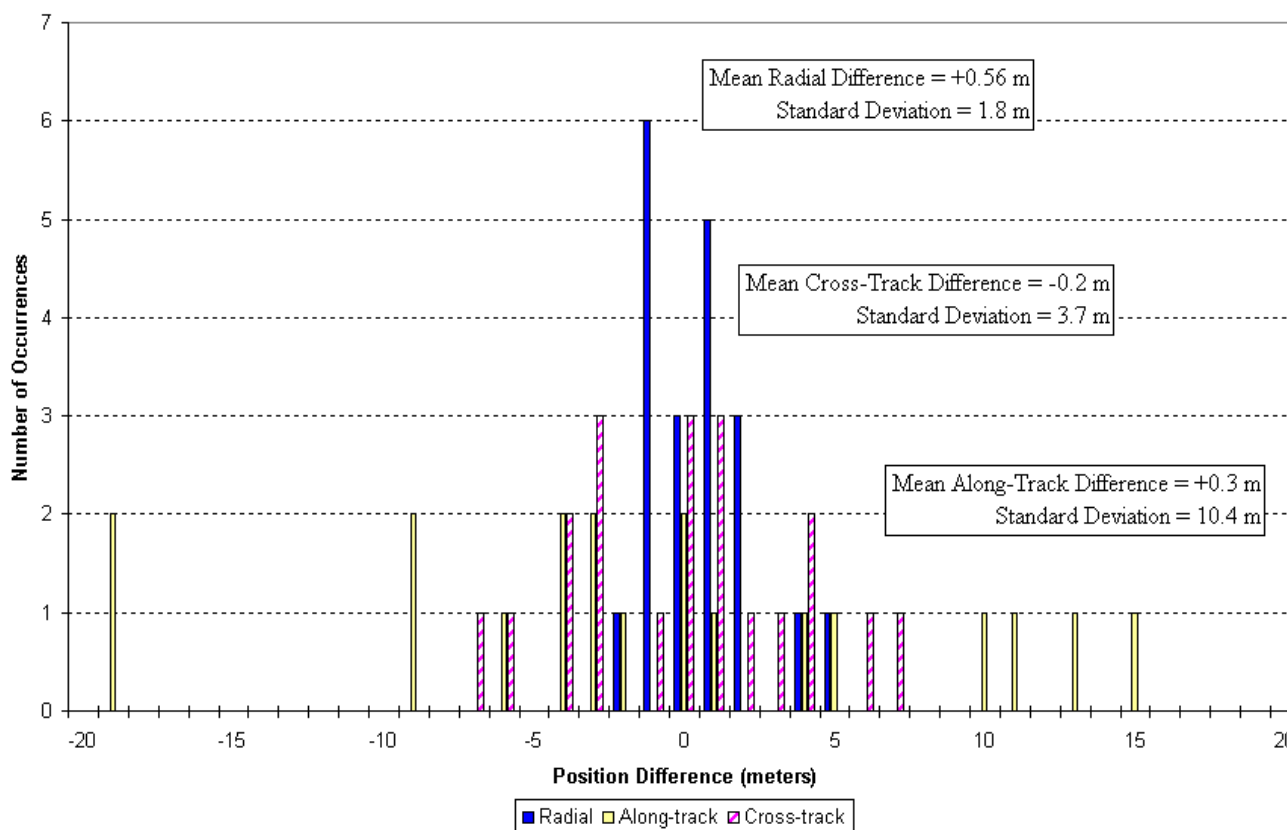
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OOE Performance



HISTOGRAM OF POSITION DIFFERENCES
(OOE minus POE)



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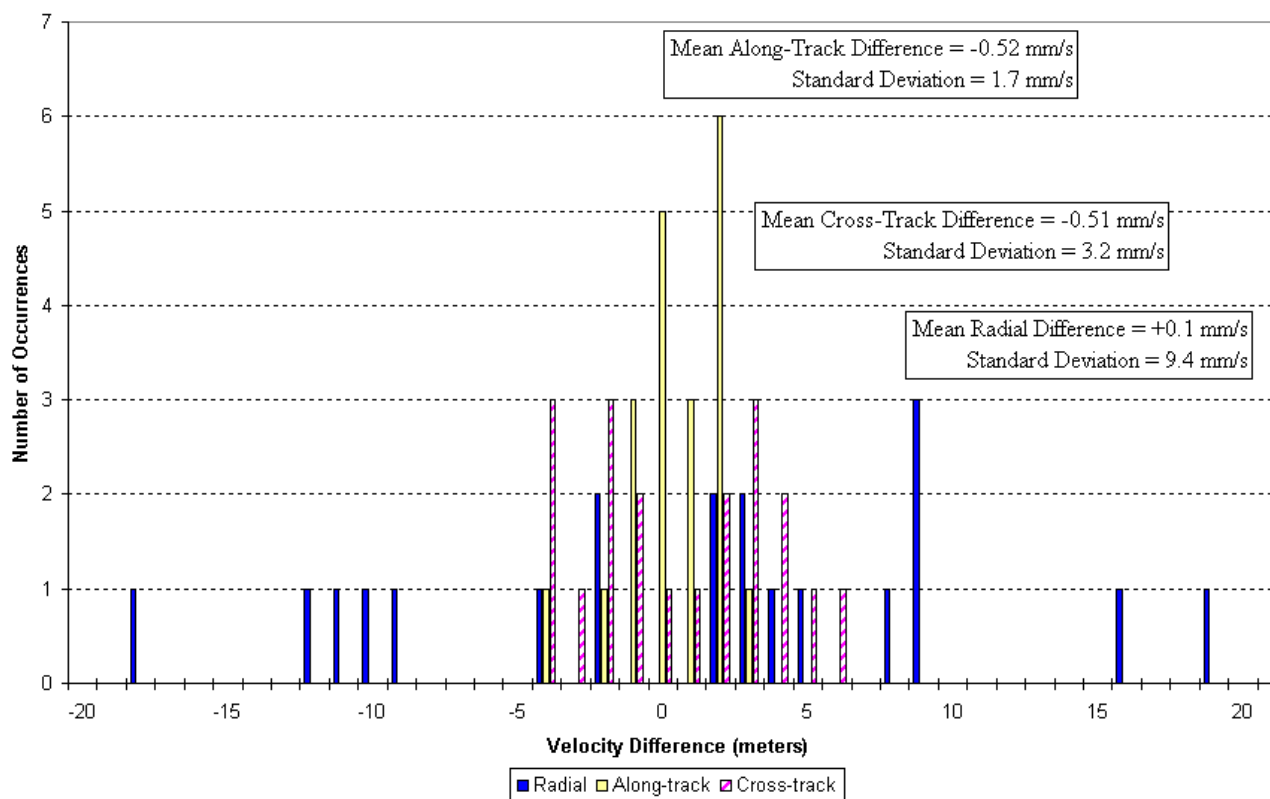
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OOE Performance



HISTOGRAM OF VELOCITY DIFFERENCES
(OOE minus POE)



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OOE Performance



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- The Operational Orbit Ephemeris (OOE) continues to meet all accuracy requirements.
 - It agrees very well with the POE and MOE Results.



POINTING ERROR REQUIREMENTS

- **Ephemeris prediction errors due to operational orbit determination are < 0.015 deg (rms)**

Equivalent to 2 km along track position error

- **Ephemeris errors due to on-board representation and computation are < 0.022 deg (rms)**

Equivalent to 2.9 km along track position error

- **Combined pointing error can be 0.027 deg (rms), equivalent to an along-track position error of 3.6 km**



EPHEMERIS REPRESENTATION ACCURACY

- Representation accuracy is routinely measured by duplicating OBC on-board computations as part of the Command Load generation process:
 - Tables 33 (T/P) and 34 (TDRSS) generated, then used to propagate ephemeris for direct comparison with original definitive OOE's
 - Along track position and angular differences computed for direct comparison with required accuracy

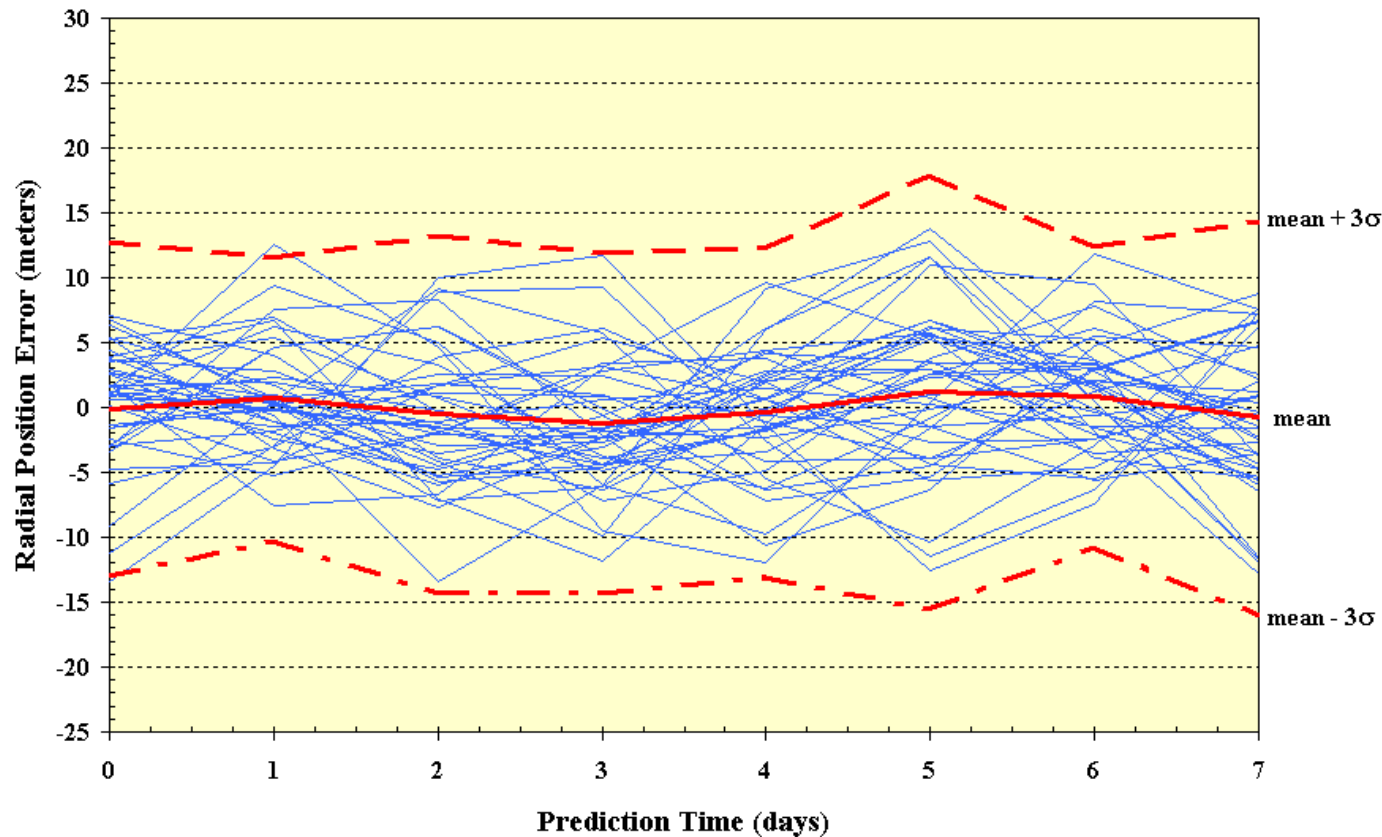
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OBC Ephemeris Performance



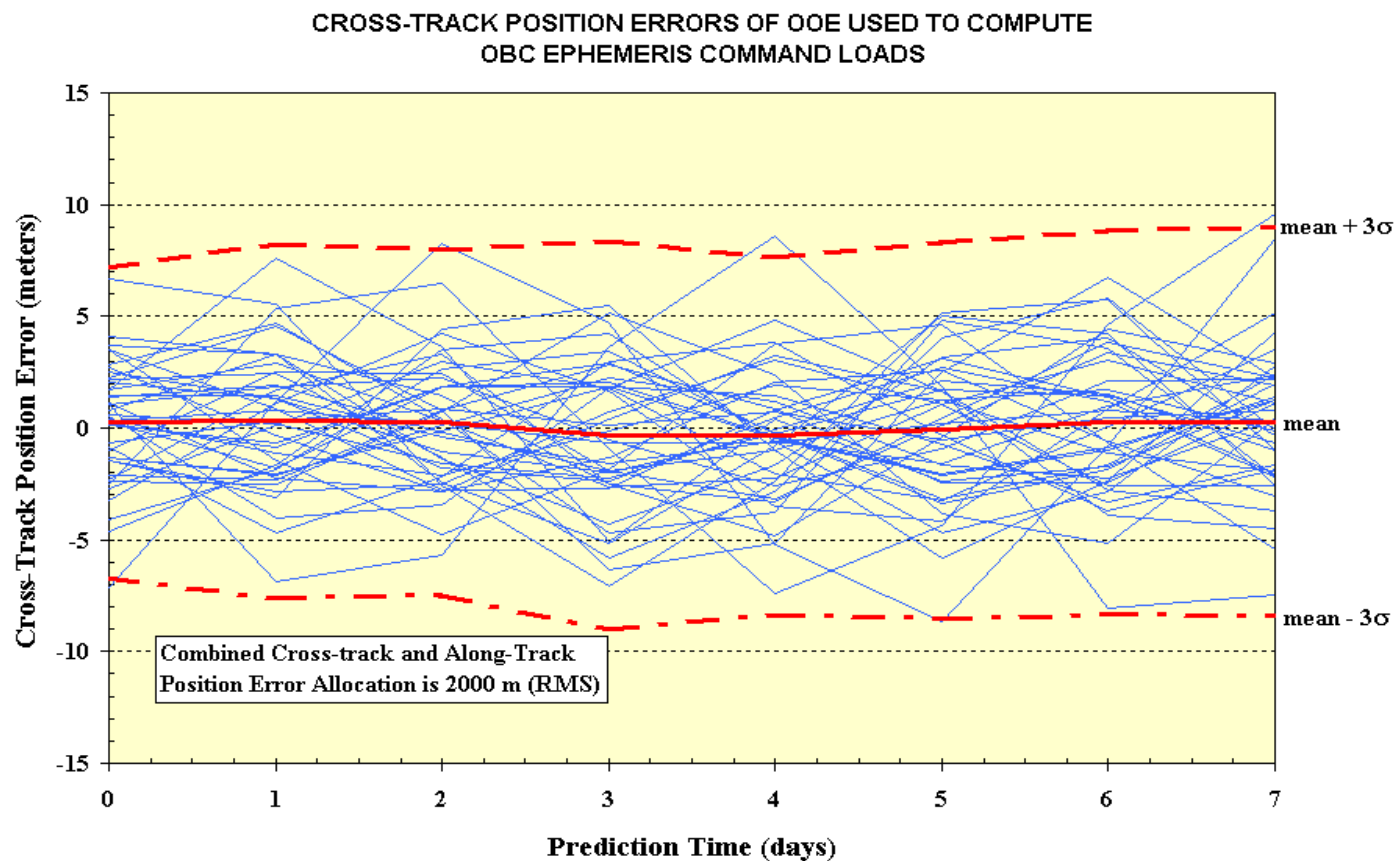
RADIAL POSITION ERRORS OF OOE USED TO COMPUTE
OBC EPHEMERIS COMMAND LOADS



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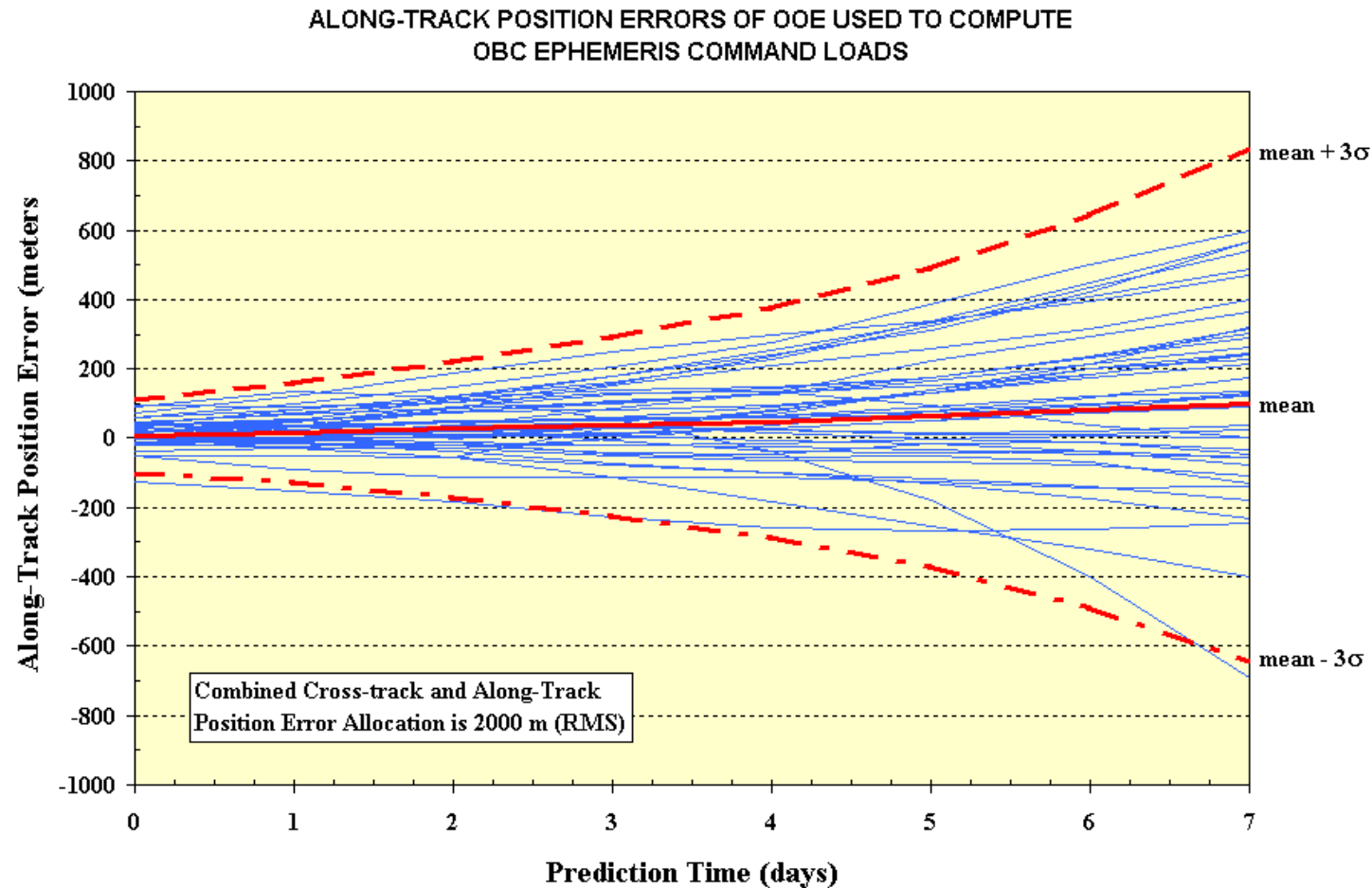
OBC Ephemeris Performance



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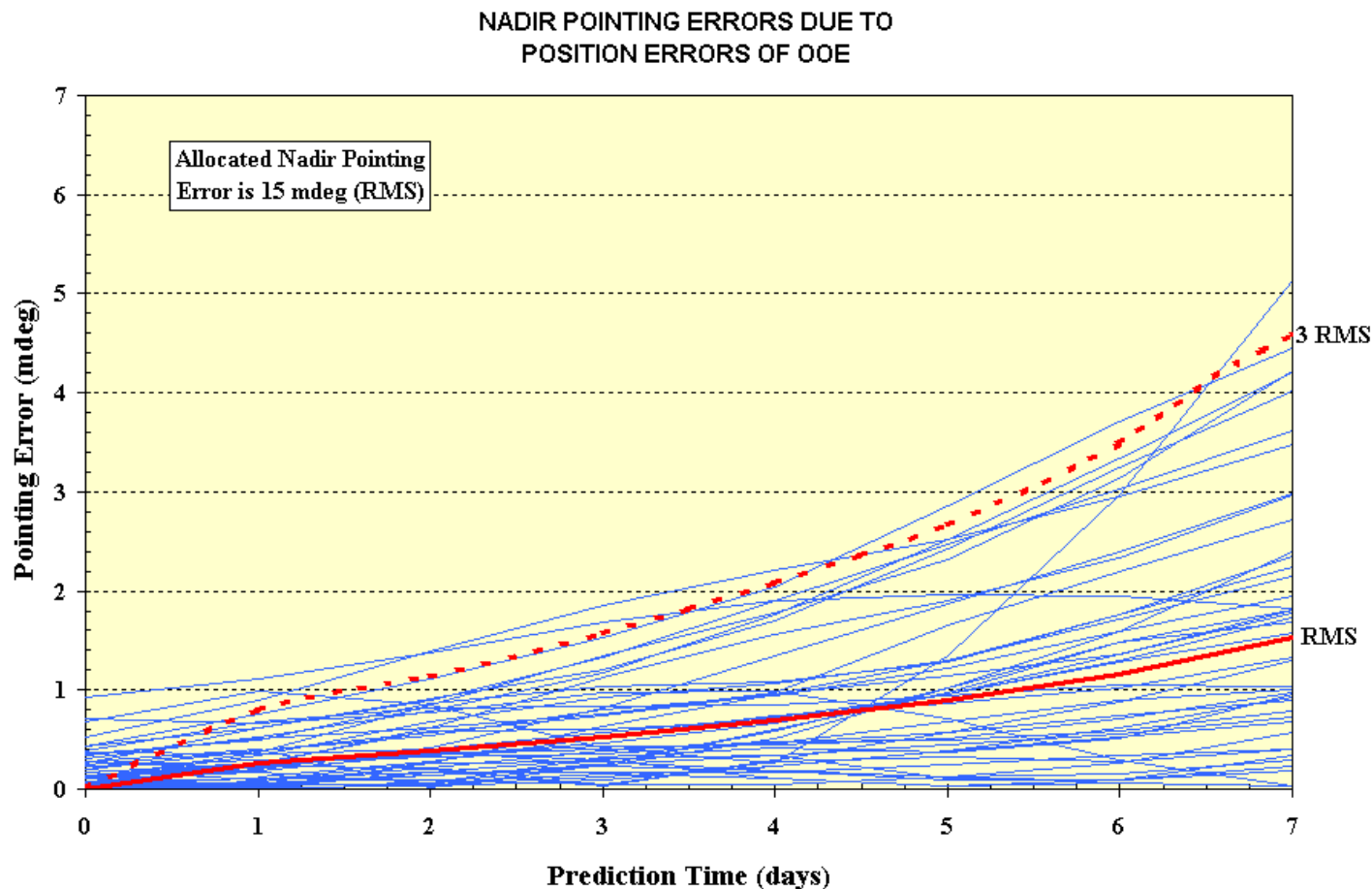
OBC Ephemeris Performance



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OBC Ephemeris Performance



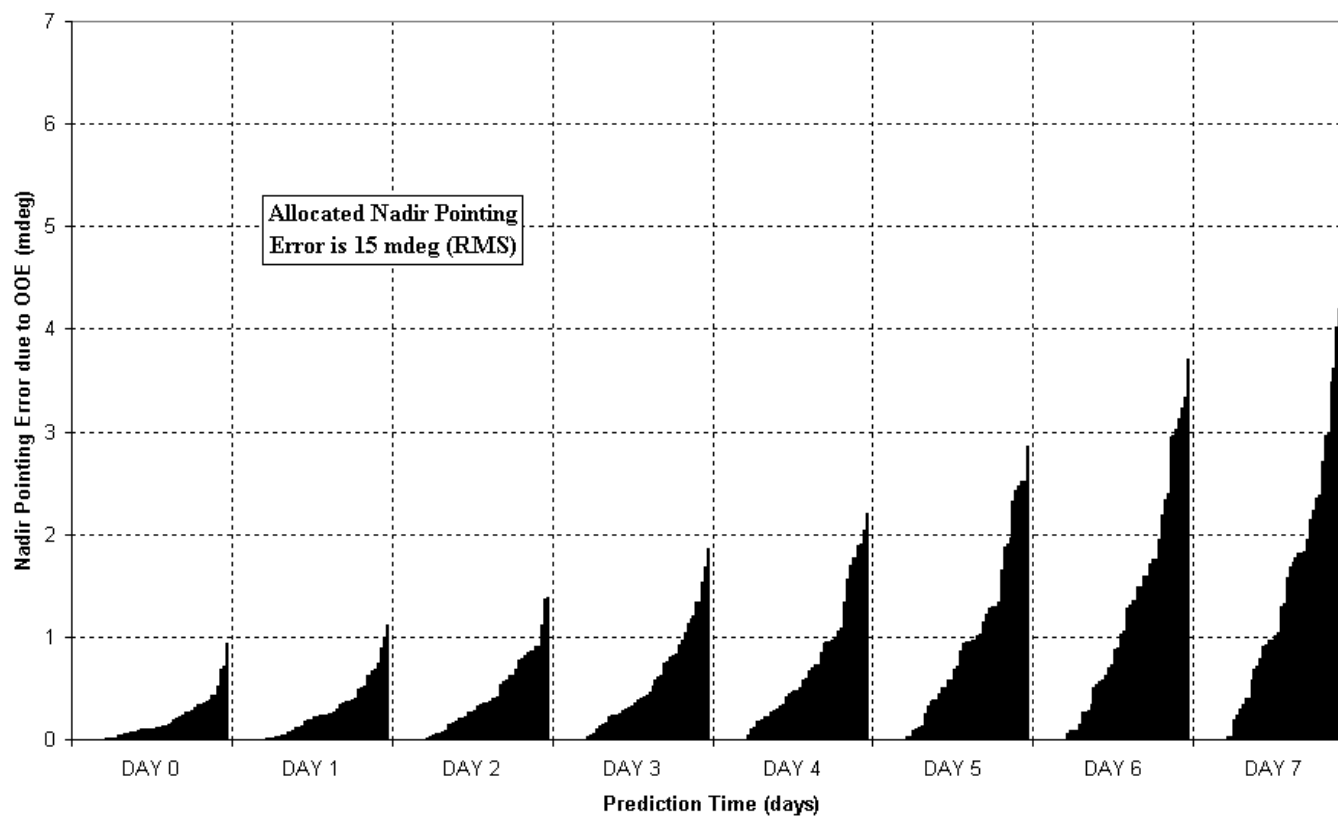
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OBC Ephemeris Performance



HISTOGRAM OF NADIR POINTING ERRORS DUE TO OOE POSITION ERRORS
FOR OBC EPHEMERIS COMMAND LOADS (SEQ0126-0226)



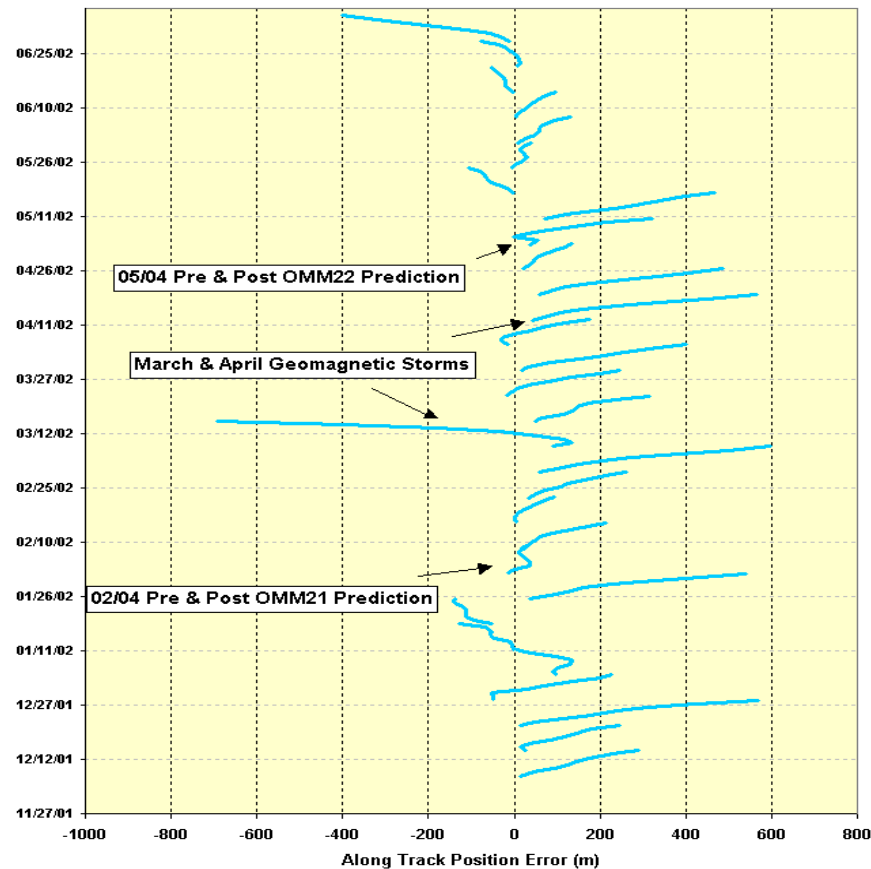
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OBC Ephemeris Performance



**ALONG TRACK POSITION ERROR OF OOE USED TO
COMPUTE OBC EPHEMERIS COMMAND LOADS**





OBC Ephemeris Performance



- **Pointing accuracy requirements placed on the OBC ephemeris command load continue to be met, including all data reported here between SEQ 01/026 and 02/026.**



Other Orbit Products



- **Generation of the Orbit Events File (OEF) and Orbit Revolution File (ORF) has continued uneventfully for the last year.**
- **Two OEFs are being generated weekly covering TDRS 41E + 171W, and 47E + 174W events.**

JPL *Automation of Orbit Products Generation* **Raytheon**

- **Orbit Products generation (FDF EPV processing, TOPEX and TDRS ephemerides, and ORF) started in automated environment in the NAVT Flight OPS at Raytheon this year.**
- **This process is being run daily / 7 days a week. Products are available each morning for NAV analyst quality assurance and delivery.**
- **This automation process will be expanded to include JASON-1, ULYSSES, and more missions in the near future.**